Comparing acceptance and rejection in the classroom interaction of students who stutter and their peers: A social network analysis

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Abstract

Purpose: Recent work has reported adverse effects of students' stuttering on their social and emotional functioning at school. Yet, few studies have provided an in-depth examination of classroom interaction of students who stutter (SWS). The current study uses a network perspective to compare acceptance and rejection in the classroom interaction between SWS and their peers in secondary education.

Methods: The sample comprised 22 SWS and 403 non-stuttering peers (22 classes) of secondary education in Flanders (Belgium). Students' nominations regarding three acceptance and three rejection criteria were combined. Social network analysis offered procedures that considered direct and indirect interaction between all classmates.

Results: We found few significant differences: SWS and their peers were distributed similarly across positive and negative status groups. Both considered and were considered by, on average, six or seven classmates as 'a friend', who they liked and could count on, and nominated or were nominated by one or two classmates as 'no friend', somebody who they disliked and could not count on. On average, SWS and their classmates also did not differ in terms of structural position in the class group (degree, closeness and betweenness), reciprocated rejection, and clique size. However, SWS do tend to be slightly more stringent or more careful in nominating peers, which led to fewer reciprocated friendships.

Conclusion: Our results suggest that SWS are quite accepted by peers in secondary education in Flanders. Such positive peer interaction can create a supportive and encouraging climate for SWS to deal with specific challenges.

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1. Introduction

In the present study the classroom interaction of students who stutter (SWS) is explored. At school there is constant interaction among students; friendships are formed, leading to social acceptance or rejection. Due to the fundamental need to connect with others, students continuously seek the support, liking and acceptance from those they value (Smith, Mackie & Claypool, 2014). The advantages of close peer relationships are well studied. Not only do they positively affect academic performance, they also help to develop social skills and competencies, help coping with life challenges and reduce stress and anxiety (Hoferichter, Raufelder & Eid, 2015; Rubin, Bukowski & Laursen, 2009; Slot & Van Aken, 2016; Steinberg & Morris, 2001). Undoubtedly, social interaction and close relationships have important implications for both physical and mental health (Bacete, Perrin, Schneider & Blanchard, 2014; Rubin et al., 2009).

However, what if someone's social interaction is unrewarding due to stuttering? Different studies have reported the adverse effects of stuttering on social and emotional functioning at school. The majority of participants in a study of Beilby, Byrnes, Meagher and Yaruss (2013) described their school-aged years as the most difficult period of their lives. Stuttering is perceived as an obstacle in participating in the full range of social activities available. For example, it could lead to choosing school activities that do not involve talking, and feeling ashamed when introducing oneself (Crichton-Smith, 2002; Hayhow, Cray & Enderby, 2002; Klompas & Ross, 2004). Furthermore, negative social experiences could result in self-doubts about the ability to be a competent communicator and, consequently, in lower self-esteem (Pearson, Child, DeGreeff, Semlak & Burnett, 2011). In this regard, Adriaensens, Struyf and Beyers (2015) found that students who perceived their stuttering as more severe scored lower on specific domains of self-esteem, such as social acceptance and the ability to make close friends. Or as Beilby et al. (2013) summarized: *"the expectancy of social harm is the anticipation of stuttering in a social context that ultimately adversely affects the public interaction and increases the people who stutter's negative self-perceptions"(*p. 26).

Taking into account the possible difficulties in social interaction, not surprisingly peer interaction of SWS has been the subject of past research. In general, studies demonstrate that students with special educational needs are more likely to be rejected (Bossaert, De Boer, Frostad, Pijl & Petry, 2015; Margalit, 2010; Pijl, Frostad & Flem, 2008). In particular, SWS could be seen as shy or withdrawn and possibly, because of these perceived characteristics, could be less accepted by peers (Davis, Howell & Cooke, 2002). Also, other, more overt characteristics, specific to stuttering, could trigger mimicking and name calling, and increase the risk of exclusion (Rose, Swearer & Espelage, 2012). Different studies indeed reported that SWS are less popular than their more fluent peers and are at increased risk of being rejected and bullied by their classmates (Blood & Blood, 2004; Blood et al., 2011; Davis et al., 2002; Erickson & Block, 2013; Hugh-Jones & Smith, 1999). However, according to Hearne, Packman, Onslow and Quine (2008) stuttering does not necessarily interfere with social life during adolescence. In addition, although stuttering often is associated with teasing and bullying, it often does not have an impact on establishing friendships (Blood, Blood, Tellis & Gabel, 2003; Daniels, Gabel & Hughes, 2012; Klompas & Ross, 2004).

1.1. A sociometric perspective on research on stuttering

The social interaction of SWS has been studied using different approaches, such as (self-) ratings of the psychosocial impact of stuttering (e.g. Erickson & Block, 2013), projective measures of social distance as perceived by non-stuttering participants (e.g. McKinnon, Hess, & Landry, 1986), retrospective self-reports (e.g. Daniels et al., 2012) and sociometric measures of classroom interaction (e.g. Davis et al., 2002). According to Davis et al. (2002) several of these methods show inherent problems and limitations. For example, retrospective studies sometimes use data of adults who stutter, looking back at their school career, sometimes more than two decades ago (e.g. Daniels et al., 2012; Hugh-Jones & Smith, 1999). Also, peer interaction and peer group status are rather difficult to measure with methods that do not involve the peer group (Rubin et al., 2009). While studies often focus merely on individual perceptions, attitudes and beliefs, a sociometric perspective also looks at interaction between actors. The basic principle of sociometrics is that every group member has to evaluate every other group member on one or more criteria. By taking into account the presence, absence and reciprocity of nominations among pairs of classmates

patterns of interaction within a classroom could be identified. In summary, by using a sociometric perspective both the perceptions of the SWS and their peers are considered to measure the social impact of stuttering.

1.2. Social Network Analysis

To our knowledge only one recent study in the area of stuttering, namely the study of Davis et al. (2002), used sociometric data to evaluate the classroom interaction of pupils and students who stutter. In accordance with many other studies on peer interaction, the sociometric measure focused on the assessment of sociometric status (Rubin, et al., 2009). This means that Davis et al. (2002) used one measure, namely the amount of nominations someone received. Social Network Analysis (SNA) (Borgatti, Everett & Johnson, 2013; Carrington, Scott & Wasserman, 2005; Scott, 2013), also relies on sociometric data, and offers a variety of measures that include information about direct (e.g., who did you nominate and who nominated you?) and indirect nominations (e.g., who nominated your friends?) of all classmates. SNA therefore offers insight in the reciprocity of nominations and in how influential a student is in the overall structure of the classroom. The latter takes into account nominations throughout all classmates (direct and indirect nominations). This way, SNA offers the potential to provide detailed insight into each student's position in the classroom and into the overall structure of classroom interaction (see also 2.3 Data Analyses). In sum, SNA provides tools of analysis to quantify and visualize a 'web of connections' or network of social life. As such, SNA yields a better understanding of the underlying patterns of social interaction of SWS within the classroom.

Since the 1970s the interest in SNA has grown extensively. The approach has been applied in different disciplines, such as sociology, social psychology and educational sciences (Brass, Labianca, Mehra, Halgin & Borgatti, 2014; Carolan, 2014). For example, students with disabilities are more likely to be identified as peripheral and even isolated, and children with autism frequently experience lower centrality, acceptance, companionship and reciprocity (Chamberlain, Kasari & Rotheram-Fuller, 2007; Farmer et al., 2011; Meredith, Struyve & Gielen, 2014). To our knowledge, SNA has not been used to explore the classroom interaction of SWS. Also, the only recent sociometric study in the field of stuttering, the

study of Davis et al. (2002), focused on young students up to 14 years old. Therefore we explored the classroom interaction of SWS in secondary education ranging from 11 to 18 years old, using SNA.

Our research focused on two aspects of classroom interaction of SWS in secondary education, namely their acceptance and rejection by their classmates. In line with the above-mentioned SNA studies of students with disabilities, this study examines whether SWS are also less accepted and more rejected compared to their peers. In accordance to Davis et al. (2002) we compared the sociometric status of SWS and their peers within the classroom. Moreover, we compared the acceptance and rejection rates between SWS and their peers, based on different SNA direct and indirect nominations measures.

2. Methods

2.1. Participants

Twenty-four SWS who were engaged in a larger study[2] and currently in secondary education were asked for their permission to conduct a classroom measurement. One student did not grant permission. Subsequently, 23 secondary education schools in Flanders (Belgium) were contacted to request their cooperation for the study. One school did not cooperate. The schools were located in rural (36%), suburban (41%) and urban (23%) areas.

In total, 425 students from 22 classes participated in the classroom measurement ($M_{\text{Nclassroom}}$ = 19, $SD_{\text{Nclassroom}}$ = 5). The classes were equally distributed among the three grades (1st = 32%, 2nd = 32%, 3th = 36%)[3]. Although all tracks were represented, more classes with students following a general track, with a college preparatory curriculum, participated at the expense of classes following a vocational track (general = 64%, technical = 23%, vocational = 14%; $\chi^2(2) = 9.32$, $p<.01$). All students who were present during the measurement participated (passive consent). Only five students (of four classes) were absent (1%).

The 22 SWS had a mean age of 14 years and six months (SD_{age} = 1.54). Fourteen (64%) were boys and eight (36%) were girls. Because of the unequal sex ratio in the prevalence of

[2] A larger study of about forty participants that stutter (11-20 years) investigated the relationship between stuttering severity and self-esteem in adolescence in Flanders (Belgium). The call for participation was distributed via schools, speech therapists and a televised appeal.

[3] Corresponding grades of education in US: 1th: 7-8th, 2th: 9-10th, and 3th: 11-12th

stuttering, not surprisingly, more male than female SWS participated. Taking into account the expected prevalence of 4:1 (boys:girls) in adolescence (Craig, Hancock, Tran, Craig & Peters, 2002), girls who stutter were close to being over-represented ($\chi^2(1) = 3.68$, $p = .06$). The SWS varied in degree of (self-reported) stuttering severity ($M = 3.35$, $SD = 1.50$, range 1.22 - 6.11) (SSS; Riley, Riley, & Maguire, 2004). Eight students were following therapy at the moment of the study, while the others had been in therapy in the past.

2.2. Instruments

Classroom interaction was measured using a social network approach with peer nomination. To prevent potential bias in the data collection towards the SWS, students (except for the SWS) were blind for the exact purpose of the study. They were told that the assessment was part of a study of interaction of students in secondary education. Class teachers, who were aware of the purpose of the study, monitored the measurement based on clear and detailed instructions in terms of preparation and completion of the measure. Because of the delicate nature of the content, privacy was carefully dealt with throughout the research process. During the data collection, it was emphasized in the instruction manual, and students were positioned so they could privately fill out the survey. All students were asked to respond to a social network survey, with six questions comprising the acceptance of classmates (... is my friend; I like ...; I can count on ...), and the rejection of classmates (... isn't my friend; I don't like ...; I cannot count on ...). The survey was complemented with a class-specific register that included the names of all their classmates. Specifically, a full network design was used, meaning that all relationships within a bounded group (the class) were mapped. For each question students were asked to mark their classmates that fit the criteria. The students were allowed to nominate as many classmates as they preferred (unlimited nomination). Sociometric measures often work with limited nominations (e.g., list your three best friends), however it seems unlikely that all students, for example, exactly have three friends. The unlimited nominations procedure therefore provides more valid information about students' classroom interaction and results in a more normal distribution of nomination data. Unlimited nominations are therefore increasingly preferred (Babcock, Marks, Crick & Cillessen, 2014; Marks, Babcock, Cillessen & Crick, 2013; Terry, 2000).

2.3. Data analyses

Social network data was imported and analysed in UCINET (Borgatti, Everett & Freeman, 2002), a network analysis software package. The missing network data from the (1%) absent student was imputed assuming that if the students had completed the survey, they would have listed all the classmates that nominated them. In network research, this approach is deemed more valid than treating the missing values as zeros (Borgatti et al., 2013).

Next, the unlimited nomination procedure could provoke students to produce long lists of nominations, also including weaker or less pronounced interaction with peers. Therefore, we combined the different networks based on the three acceptance (... is my friend; I like ...; I can count on ...) or rejection questions (... isn't my friend; I don't like ...; I cannot count on ...) to represent one more stringent acceptance or rejection network. The association between the three acceptance and three rejection networks was studied following the Quadratic Assignment Procedure (QAP) (Borgatti et al., 2013; Krackhardt, 1987). QAP instead of Pearson correlations must be used to run association analysis on social networks as relations between individuals are nested and embedded within the same network. A low p value ($p < .05$) suggests an association between the networks that is unlikely to have occurred by chance (Baker & Hubert, 1981). The procedure was completed per classroom. Then these associations were aggregated to indicate overall QAP correlations that represent the similarity between the three acceptance and three negative networks over all sample classes. If association was proven, networks were combined to end up with one acceptance and one rejection network per classroom, summarizing the accepting and rejecting classroom interaction. This means that only if a student nominated a classmate on the different acceptance (or rejection) questions, the nomination was preserved.

Detailed information about the processes of collecting, cleaning and analyzing the network data (incl. the quadratic assignment procedure) is included in appendix A.

To explore the accepting and rejecting interaction of SWS in their classrooms, we calculated various network measures (Borgatti et al., 2013; Hanneman & Riddle, 2005; Moolenaar, 2010; Scott, 2013). Table 1 gives an overview of the SNA measures used in the study.

Table 1: SNA measures in the study

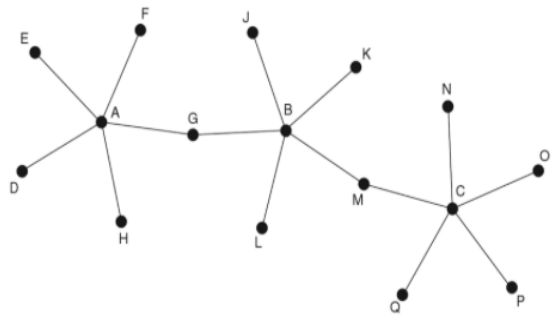
Centrality	*Degree*	The number of nominations *Indegree*[1]*:* The number of nominations someone received. It provides information about someone's (un)popularity *Outdegree*: The number of nominations someone sent out, giving information about someone's social activity (approach or distance)
	Closeness	How 'close' is someone to all members, but also how accessible is their support *Out-closeness*: The distance to reach all members *In-closeness*: The distance to be reached by all members
	Betweenness	The extent to which someone occupies a controlling or intermediary position, building a bridge between otherwise disconnected people
Reciprocity	*Dyadic reciprocity*	The percentage of someone's nominations that is returned
	Cliques (size)	Membership of a clique; the size of the largest subset of a network (n > 2) in which every possible pair of members is directly and reciprocated connected

[1]*Status-groups are based on indegree centrality*

Firstly, centrality measures are calculated. Centrality is a property of a student's position in a classroom, in other words, his or her structural importance. A student with a more central position has more opportunities to have social contacts. *Indegree centrality*, i.e. the number of nominations a student received, in the acceptance network was used to measure peer acceptance. Similarly, peer rejection represents the number of incoming nominations received in the negative network. In accordance with Davis et al. (2002), the students were classified into social status groups based on their peer acceptance and peer rejection scores. Following the standard procedure by Coie, Dodge and Coppotelli (1982), peer acceptance and peer rejection scores were standardised within each class (ZPA and ZPR). A social preference score was created as the standardised peer acceptance score minus the standardised peer rejection score. A social impact score was computed by summing both scores. The social preference and social impact scores were again standardised within each classroom (ZSP and ZSI). Finally, students were assigned to five *social status* types using the following decision rules (Coie & Dodge, 1983): (a) Popular, receiving a ZSP score > 1.0, a ZPA score > 0, and a ZPR score < 0. (b) Rejected, receiving a ZSP score < -1.0, a ZPA score < 0 and a ZPR score > 0. (c) Neglected, receiving a ZSI score < -1.0, a ZPA score < 0 and a ZPR score < 0. (d) Controversial, receiving a ZSI score > 1.0, a ZPA score > 0 and a ZPR score > 0. (e) Average, comprises everyone who did not meet the before mentioned criteria. In summary, indegrees tell us something about students' (un)popularity. Next to in-degree analyses, we

also studied *out-degrees*, i.e. the number of outgoing nominations, giving information about students' social activity.

As illustrated in Figure 1, students with a similar amount of nominations or degree centrality (students A, B, and C) do not necessarily occupy a similar prominent position at the centre of the class. Student B has a more central position in the overall classroom network. Other centrality measures than degree centrality, such as closeness and betweenness centrality, take into account connections throughout all classmates (direct and indirect nominations). *Closeness centrality,* indicates how 'close' a student is to his or her classmates, but also how accessible classmates' support is. Out-closeness measures reflect the distance to reach classmates, while in-closeness is based on the distance to be reached. Normalised closeness scores are used to facilitate comparisons among participants (Hanneman & Riddle, 2005). *Betweenness* as well as degree and closeness centrality is a well-cited measure of centrality. It is operationalized as the extent to which a student occupies a controlling or intermediary position, building a bridge between otherwise disconnected students. Again, normalised scores are used (Hanneman & Riddle, 2005). Normalised closeness and betweenness scores vary between zero and one, with a score approaching one indicating a student that occupies a very central position in the classroom's social network.



		A,C	B	G,M	J,K,L	Other
Degree	Absolute	5	5	2	1	1
	Relative	.33	.33	.13	.07	.07
Closeness		.35	.45	.41	.31	.26
Betweenness		.48	.71	.48	.00	.00

Figure 1: Degree vs. closeness centrality (Scott, 2013, p.85)

Closeness and betweenness are difficult or less relevant to interpret when applied to a negative network (Borgatti et al., 2013). Therefore these centrality analyses are only performed on the acceptance networks.

Secondly, we studied reciprocity in the acceptance and rejection network in pairs and larger subgroups. *Dyadic reciprocity* is calculated as the percentage of nominations of a student that is returned, ranging from 0 (no nominations are reciprocated) to 100 (all nominations are reciprocated). If mean differences in reciprocity between SWS and their peers occur, other reciprocity proportions produced by UCINET could offer more insight into the origin (indegree or outdegree) of these differences: (a) $Outdegree_{NonRec}/NonRec$: the number of non-reciprocated outgoing nominations divided by the total number of non-reciprocated nominations, (b) $Outdegree_{Rec}$ */Outdegree*: the number of reciprocated outgoing nominations divided by the total number of outgoing nominations and (c) $Indegree_{Rec}$ */Indegree*: the number of reciprocated incoming nominations divided by the total number of incoming nominations.

Clique size as well as dyadic reciprocity takes into account reciprocated nominations: a cohesive subgroup or a clique is a subset of a classroom network ($n > 2$) in which every possible pair of classmates is directly connected, or in other words in which all students are closely and intensely tied to one another. Only strong cliques (reciprocated nominations) were considered. Since the clique procedure in UCINET allowed individuals to be members of more than one clique, students were assigned to their largest clique. Clique size was normed relative to class size. We studied clique membership in the acceptance network.

Based on these analyses, information on classroom interaction was added to an SPSS data set. Comparative analyses, namely independent-samples t-tests were applied to compare the means of the abovementioned variables of SWS and their peers. To explore differences in frequencies in social status categories between SWS and their peers, a Chi-square test was used. Finally, examples of network maps were generated using NetDraw - UCINET version 2.157 (Borgatti, Everett & Freeman, 2002) to visualize the different SNA variables.

3. Results

3.1. Preliminary QAP analyses

The average Jaccard coefficients summarizing associations between the three acceptance networks over the sample classes indicate that acceptance networks are moderately to strongly associated (Table 2). Also, provided *p* values indicated highly significant relationships in the different classes. Although the rejection networks are less strongly associated (Table 3), to great extent the *p* values support the idea that the different rejection networks are also associated. One classroom (*n* = 11) was not included in the analyses of rejecting classroom interaction, because the 'no friendship' and 'disliking' networks and the 'no friendship' and 'no counting on' networks were not associated (see Table 3). A combined acceptance and rejection network was constructed. Only if student A nominated student B as a friend, liked B and thought he or she could count on B, the nomination of acceptance was preserved. Similarly, only if student A thought B is not a friend, disliked B and thought he or she could not count on B, the nomination of rejection was confirmed. Considering the unlimited nomination procedure, this more stringent definition of accepting and rejecting interaction increases the likelihood that mostly meaningful interaction remains.

Table 2: Average Jaccard coefficients (95% confidence interval values) between acceptance networks (N = 22)

	Friendship	**Liking**	**Counting on**
Friendship	1.00	.61 (.54 - .68)	.56 (.48 - .64)
Liking		1.00	.55 (.47 - .63)
Counting on			1.00

Table 3: Average Jaccard coefficients (95% confidence interval values) between rejection networks (N = 22)

	No friendship	**Disliking**	**No counting on**
No friendship	1.00	.43 (.34 - .52)	.34 (.24 - .44)
Disliking	[*.10*]	1.00	.35 (.25 - .45)
No counting on	[*.16*]		1.00

[*non-significant p values in one of the sample classes*]

3.2. Differences in classroom interaction between SWS and their peers

3.2.1. Centrality

Indegree and Outdegree

Table 4 presents the average numbers of incoming and outgoing nominations of SWS and their peers in the acceptance and rejection network, or in other words the average number of received or sent nominations. Comparative analyses showed no mean differences between SWS and their classmates. The overall average outdegree is the same as the average indegree, because each outgoing nomination from a student also implies an incoming nomination for another student. The variability among students in indegree and outdegree however could be different. Overall, students on average nominate and are nominated by six or seven classmates as a friend, who they like and can count on. Similarly, students on average nominate and are nominated by one or two classmates as 'no friend', somebody who they dislike and cannot count on. Table 4 describes the results of comparative analyses using normalised in- and outdegrees as well as raw scores. The normalised scores take into account class size and can be interpreted as the percentage of a student's incoming or outgoing nominations on all possible incoming or outgoing nominations (class size minus one). Again SWS and their classmates do not differ in normalised degree scores. Overall, students on average nominate and are nominated by approximately a third of their classmates as a friend, who they like and can count on. Similarly, students on average nominate and are nominated by less then 10 per cent of their classmates as not a friend, somebody who they dislike and cannot count on.

Table 4: Descriptive statistics and mean differences for in- and outdegrees between SWS and their peers (raw scores and percentages of the students' class)

		Total		SWS		Peers		M differences	
		M	***SD***	***M***	***SD***	***M***	***SD***	***t***	***p***
Raw	**Acceptance network**								
	Outdegree (social approach)	6.45	3.97	6.09	4.86	6.47	3.93	-.44	.66
	Indegree (peer acceptance)	6.45	3.50	6.50	3.74	6.45	3.49	.07	.95
	Rejection network								
	Outdegree (social distance)	1.61	1.90	1.76	2.28	1.60	2.25	.33	.75
	Indegree (peer rejection)	1.61	2.25	1.48	1.75	1.61	1.91	-.32	.75
%	**Acceptance network**								
	Outdegree (social approach)	33.42	19.40	33.95	24.71	33.39	19.11	.13	.90
	Indegree (peer acceptance)	33.42	17.48	36.63	21.19	33.25	17.27	.88	.38
	Rejection network								
	Outdegree (social distance)	8.40	11.70	9.80	14.35	8.32	11.56	.56	.57
	Indegree (peer rejection)	8.40	10.13	7.56	9.35	8.44	10.17	-.39	.70

Acceptance network: SWS n = 22; peers n = 403
Rejection network: SWS n = 21; peers n = 393

Based on the peer acceptance and peer rejection scores the students were classified into five social status groups (Table 5). 23.8% of SWS were found to be popular, compared to 13.5% of their peers. Also, our participating SWS were not found to be controversial. However, a chi-square test indicated that there were no significant differences in the proportions of students with a more positive (i.c. popular), negative (i.c. rejected, neglected or controversial) or average status between SWS and non-stuttering peers ($\chi^2(2) = 2.25$, $p = .32$). An average status comprises everyone who does not meet the other status groups. The frequencies of the more negative status groups, namely, rejected, neglected and controversial, were summed to answer to the assumption for chi square analysis, that at least 80% of cells should have expected frequencies of five or more.

Table 5: Percentage of SWS and their peers per social status group

Social status group	Total	SWS	Peers
Popular	14.0	23.8	13.5
Rejected	16.7	19.0	16.5
Neglected	10.1	14.3	9.9
Controversial	3.4	0.0	3.6
Average	55.8	42.9	56.5

SWS n = 21; peers n = 393

Closeness and Betweenness

Comparative analyses showed that SWS and their peers are similarly close to their classmates (Table 6). Closeness scores, based on the effort to reach or be reached, or to look for or get support by all classmates, are normed against the maximum possible value for a class of the same size and connection. Overall, our participants scored on average a normalised out-closeness and in-closeness of approximately 50%. SWS and their peers' betweenness centrality is 5% in the acceptance network. Betweenness is expressed as a percentage of the maximum possible betweenness that each student could have had. This implies that our students, in general, seldom occupy a controlling or intermediary position in their classroom's social networks.

Table 6: Descriptive statistics and mean differences in closeness and betweenness between SWS and their peers (normalised scores)

	Total		SWS		Peers		M differences	
	M	***SD***	***M***	***SD***	***M***	***SD***	***t***	***p***
Acceptance network								
Out-closeness	.51	.14	.48	.18	.51	.14	-.85	.40
In-closeness	.50	.13	.53	.15	.50	.13	1.12	.26
Betweenness	.05	.06	.05	.05	.05	.06	.15	.88

SWS n = 22; peers n = 403

3.2.2. Reciprocity

Dyadic reciprocity

Findings regarding dyadic reciprocity (Table 7) suggest that of all incoming and outgoing nominations of SWS in the acceptance network, on average, 34% are reciprocated. Their peers demonstrated a mean reciprocity rate of 44%. Comparative analyses resulted in a significant difference, but the magnitude of the difference was rather small. When looking at the subsequent analyses, which elucidate the difference in reciprocity, one nearly significant difference stands out. Of the, on average, six to seven outgoing nominations of both SWS and their non-stuttering peers, approximately four are reciprocated. However, of the, on average, six to seven incoming nominations, SWS probably only reciprocated approximately three to four, while their peers on average reciprocated four. So the percentage of incoming nominations that are reciprocated is practically lower for SWS in comparison with their peers.

Reciprocity analyses of the negative network indicated no mean differences between SWS and their peers. On average, 11% of all incoming and outgoing nominations of our participants are reciprocated; namely, less than one outgoing nomination and less than one incoming nomination. Finally, results showed that there is more variability between non-stuttering peers than between SWS in the percentage of incoming negative nominations that are reciprocated (p = .05).

Clique size

We also studied clique membership based on the acceptance network. As shown in Table 7, analyses did not indicate a significant difference in mean clique size. The cohesive subgroups of the SWS and their non-stuttering peers, in which all members are reciprocally connected,

have an average size of approximately 14% of class size. This corresponds to, on average, a three-member clique (*M* = 2.84, *SD* = 2.00).

Table 7: Descriptive statistics and mean differences in reciprocity between SWS and their peers

		Total		SWS		Peers		M differences		
		M	***SD***	***M***	***SD***	***M***	***SD***	***t***	***p***	η^2
ACC	**Dyadic reciprocity**	.44	.23	.34*	.22	.44*	.23	-1.99	.05	.01
	$Outdegree_{NonRec}$/NonRec	.48	.36	.45	.39	.48	.36	-0.43	.67	
	$Outdegree_{Rec}$ /Outdegree	.65	.28	.60	.27	.65	.28	-0.70	.49	
	$Indegree_{Rec}$ /Indegree	.63	.28	.52	.31	.64	.28	-1.82	.07	
	Clique size	.14	.10	.12	.10	.14	.10	-.94	.35	
REJ	**Dyadic reciprocity**	.11	.22	.06	.11	.11	.22	-0.96	.34	
	$Outdegree_{NonRec}$/NonRec	.46	.43	.48	.44	.46	.43	0.24	.81	
	$Outdegree_{Rec}$ /Outdegree	.24	.33	.15	.23	.24	.33	-0.87	.38	
	$Indegree_{Rec}$ /Indegree	.23	.35	.15	.21*	.23	.35*	-1.25	.24	

Acceptance network: SWS n = 22; peers n = 403
Rejection network: SWS n = 21; peers n = 393
**Statistical significant difference*

The results of the differences in SNA measures between SWS and their peers are summarized in Figure 2 (Acceptance network) and Figure 3 (Rejection network). Only one measure differs significantly, namely the lower dyadic reciprocity of SWS compared to their peers.

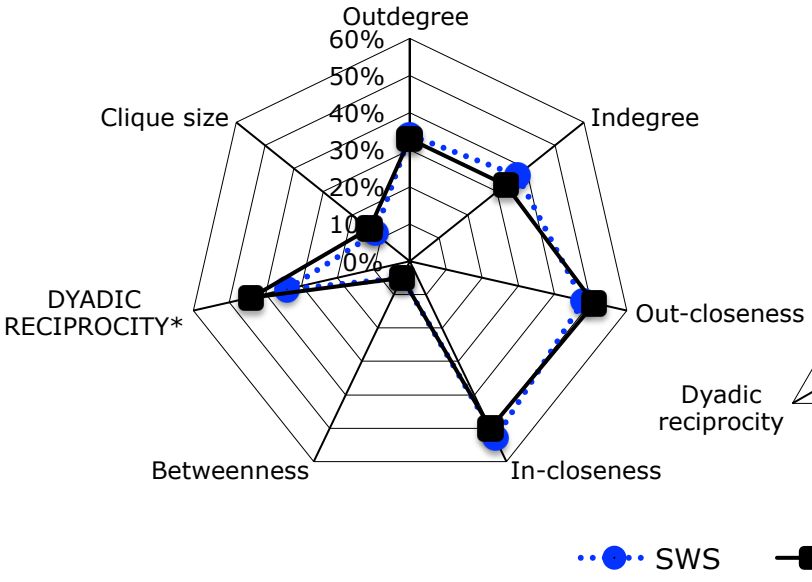


*Figure 2: Average results of acceptance of SWS and their peers (based on normalised scores) (*significant difference)*

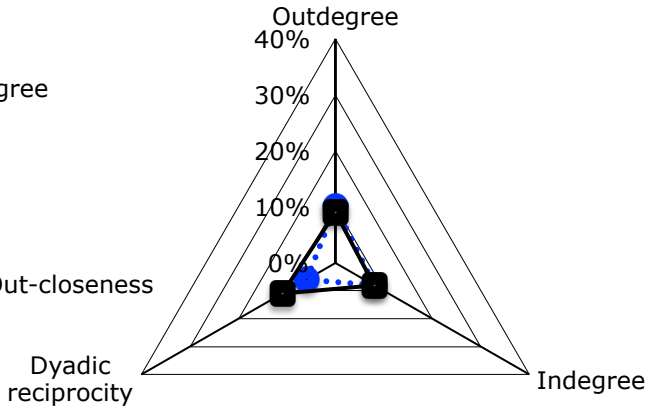


Figure 3: Average results of rejection of SWS and their peers (based on normalised scores)

3.3. Network visualization

In Figures 4 and 5, we provide a typical acceptance and rejection network of a participating class. In these social network visualizations the SWS, Roy (fictitious name) is represented by a blue circle. Non-stuttering classmates are represented by black squares. Outgoing arrows represent the number of nominations a student sends to his or her classmates, while incoming arrows represent the number of times he or she is nominated by classmates. Reciprocated nominations are represented by thick blue lines, and non-reciprocated nominations are thin black lines.

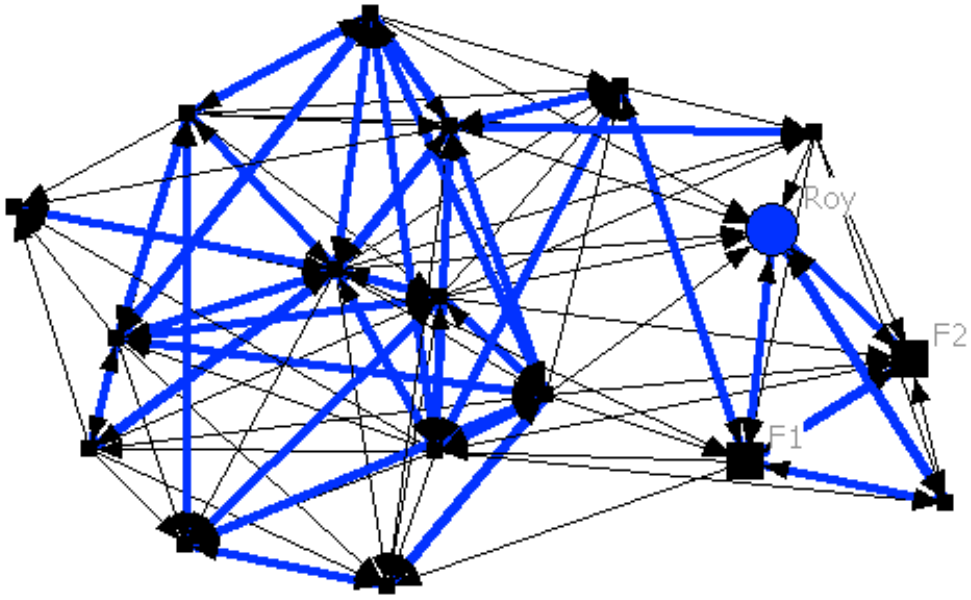


Figure 4: Example of an acceptance network (n = 18)

Figure 4 shows that Roy nominated (i.e., his outgoing arrows) three classmates as a friend, who he likes and can count on. Roy himself however was nominated nine times by classmates (i.e., his incoming arrows). The class mean in- and outdegree in the acceptance network is approximately seven nominations. Roy's normalised in-closeness score of .68 indicates that in comparison with other classmates, Roy is appointed a rather central position in the class. In addition, given his normalised out-closeness score of .40, this implies that Roy will be more sought for support by his classmates rather than reaching out for support himself. The betweenness score of .02 points out that Roy seldom takes in an in-

between or intermediary role in class. Regarding reciprocity, the thick blue lines illustrate that all of Roy's outgoing nominations were returned. Six classmates who accepted Roy as a friend, who they like and can count on, did not receive a nomination back from Roy. It seems that, as we concluded, Roy is rather careful or stringent in returning his nominations. Finally, we see that Roy is a member of a cohesive subgroup with two other friends (F1 and F2). This clique size corresponds to the class' mean clique size.

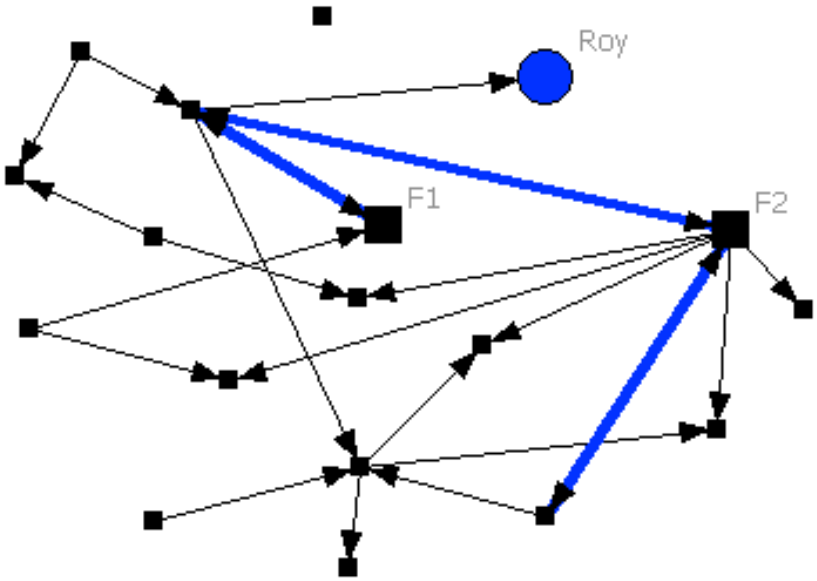


Figure 5: Example of a rejection network (n = 18)

Figure 5 shows that Roy is only rejected by one classmate, a feeling that is not reciprocated by Roy himself. This classmate, however, is relatively more rejected by other classmates. If we consider the indirect relations surrounding Roy, we see that the two other friends of Roy's clique are more rejected, in comparison to Roy.

Based on both visualizations, we can conclude that Roy, as a SWS, is certainly not less accepted or more rejected than his peers.

4. Discussion and conclusion

The current study explored and compared SWS and their classmates' accepting and rejecting interaction using social network analysis, a promising method in social sciences. Our study is

innovative because, firstly, the acceptance and rejection network reflected a combination of students' nominations of classmates regarding three acceptance (friends with, like, can count on), and three rejection (no friend, dislike, cannot count on) network criteria. This way, mostly pronounced classroom interaction or relationships remained. Secondly, a network approach allowed us to grasp in detail the patterns of interaction between SWS and their peers in the classroom, taking into account both SWS and their classmates perspectives. Moreover, the few sociometric studies in the field of stuttering mostly focused on sociometric status, considering only direct interaction between SWS and their classmates. SNA however offers a variety of procedures that consider both direct and indirect interaction between all classmates. Degree centrality or sociometric status and dyadic relationships explore direct interaction, while students' closeness and betweenness and clique membership take into account overall classroom interaction. This approach yielded in-depth insight into SWS's structural position in the classroom in terms of peer acceptance and rejection. Finally, although Davis et al. (2002) explored the interaction of young SWS, what was still missing was the study of classroom interaction of SWS in secondary education ranging from 11 to 18 years old.

Although past studies often concluded that SWS are less popular and are at increased risk of being rejected and bullied (Blood & Blood, 2004; Blood et al., 2011; Davis et al., 2002; Erickson & Block, 2013; Hugh-Jones & Smith, 1999), our results demonstrated few significant differences in self-reported social interaction patterns between SWS and their non-stuttering peers. Both SWS and their peers considered and were considered by, on average, six or seven classmates, which is approximately a third of their class, as a friend, who they liked and could count on. Similarly, overall, the students nominated and were nominated by, on average, one or two classmates as not a friend, somebody who they disliked and could not count on. Subsequently, when classified into social status groups, SWS and their peers are distributed similarly across the positive and negative groups. These results differ from the sociometric study of Davis et al. (2002), who concluded that stuttering participants were more likely to be rejected and less likely to be popular. Although these contrasting results may partly be due to differences in characteristics of participants (e.g., limited age range, clinical sample, cultural differences) or of procedure and analyses (e.g., limited nomination procedure, one network criterion), the differences in results between both studies are

pronounced. In this regard, it appears that the overall percentages in our study, namely 14% of our students were found to be popular, 16.7% rejected, 10.1% neglected, 3.4% controversial and 55.8% average, resemble more the percentages that occur in many other adolescent studies, in comparison with the study of Davis et al. (Rubin et al., 2009; Slot & Van Aken, 2016).

Also, other centrality analyses indicated that SWS and their peers occupied similar social positions in their classroom, which support the conclusion that SWS on average do not appear to interact less or more negatively in comparison with their peers. There is one exception; namely, SWS tend to be slightly more stringent or more careful in nominating acceptance, which led to less reciprocated friendships. However, if we look at membership in larger cohesive subgroups or cliques, our results again show that both SWS and their classmates, on average, belong to a three-member clique. Also, in terms of reciprocated rejection, SWS and their classmates, on average, did not differ.

Social Network Analysis however involves more than visualising and analysing networks. Attributes of the people residing in the network, such as demographic or the personality characteristics of participants, could predict or be predicted by social interaction. For example, maybe stuttering leads to fewer mixed sex friendships, or differences in interaction occur when age is taken into account. Or maybe classmates' stereotypical attitudes towards people who stutter affect the position of SWS in class. Future studies could include such additional information of classmates, offering more insight in if, and to what extent, students' characteristics affect or relate to acceptance or rejection of SWS.

Our results suggest that SWS are quite accepted by peers in secondary education in Flanders. This finding was also confirmed by their teachers (Adriaensens & Struyf, 2016). Or as also Blood et al. (2003) concluded, stuttering often does not present a stigmatizing condition for SWS. Given the importance of the peer group to the adolescent, Hearne et al. (2008) stated that it seems critical that stuttering is accepted by friends. Taking into account that stuttering is often accompanied by shame, social concerns, or fear of negative evaluation in social situations (Bloodstein & Ratner, 2008; Messenger, Packman, Onslow, Menzies & O'Brian, 2015), positive peer relationships could function as a buffer and protect SWS in stressful situations and during negative experiences at school. Moreover, the support

of friends could be a significant factor protecting them from being teased (Adams, Santo & Bukowski, 2011; Cohen & Wills, 1985; Hearne et al., 2008). Therefore, friends could also be involved in therapy on stuttering, considering their potential role in supporting the self-acceptance of SWS. To conclude, positive peer interaction can offer a positive climate for SWS to deal with specific challenges, with encouraging and supportive peers.

Appendix A: Data management and Quadratic Assignment Procedure

Per classroom, six *network adjacency matrices* in correspondence with the six network questions were constructed in UCINET (Borgatti, Everett & Freeman, 2002). Each matrix represents a dataset reflecting one network question, with both rows and columns containing all students of a particular class. If student A nominated student B, value 1 was entered in cell X_{ab} (nomination), and if student A did not nominate student B, value 0 was entered in cell X_{ab} (non-nomination). In the analyses, special attention was paid to the missing network data from the (1%) absent students, as only partial information is available on these students' interaction; the absence of these students creates a row of missing values in the network matrices. An obvious solution is to eliminate these students from the analysis, yet this approach would make the remainder of the network incomplete. Instead, as suggested by Borgatti and colleagues (2013), the missing row was imputed with data from the corresponding column. The underlying assumption is that if the students had completed the survey, they would have listed all the classmates that nominated them. In network research, this approach is deemed more valid than treating the missing values as zeros (Borgatti et al., 2013).

We studied the association between the three acceptance and three rejection network matrices within each classroom conducting a series of *Quadratic Assignment Procedure* (QAP) correlations (Borgatti et al., 2013; Krackhardt, 1987). In social networks relations between individuals are embedded within the same network. In other words, when calculating the association between two network matrices, typically, observations in the same row or column will be positively correlated. QAP takes into account this interdependency of social network data; it calculates a measure of association in which the rows and columns of one of two matrices is randomly permuted, as well as a standard

measure of association. This permutation is performed 10,000 times in order to compare the proportion of times that the random measures are larger than or equal to the observed measure. A low proportion ($p < .05$) suggests a relationship between the matrices that is unlikely to have occurred by chance (Baker & Hubert, 1981). The procedure was completed for the three acceptance and three negative networks separately, producing two 3x3 correlation matrices per classroom. Then we aggregated these associations using matrix algebra to indicate overall QAP correlations that represent the similarity between the three acceptance and three negative networks over all sample classes. The Jaccard coefficient is used as a measure of association when variables are dichotomous and subsequently, when relations or ties (cf. nominations) are binary (Hanneman & Riddle, 2005). Next, if association was proven, matrices were combined to end up with one acceptance and one rejection network per classroom, summarizing the accepting and rejecting classroom interaction. This means that only if student A nominated student B on the different acceptance (or rejection) questions, value 1 was entered in cell X_{ab}. Otherwise, value 0 was entered.

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